THE GRAIN SORGHUMS: IMMIGRANT CROPS THAT HAVE MADE GOOD.

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INTRODUCTION.

THE world is being searched for new plants for the American farm and garden. Some of those introduced in comparatively recent years have become staple and valuable crops. Among these are durum wheats, Swedish Select and Kherson Sixty-Day oats, and others. We call them no longer foreigners but Americans. Other introductions which now seem strange and new will become familiar in the next decade or two. Many others will never become known because they are not adapted to our environmental or economic conditions.

The grain sorghums are rather stout and mostly tall plants of the grass family, distantly related to corn. The grain is not found in ears, for they have none, but in heads which they bear where corn carries its tassel. There are several groups of these grain makers, known by different names. Among them are the durras, including feterita, and the milos, which have mostly short, fat heads and large flat seeds; the stout, broad-leaved kafirs, which have longer heads, full of small, egg-shaped seeds, and the slender, dry-stemmed kaoliangs with mostly small, oval seeds borne in heads of various shapes.

While not of wide adaptation under present conditions, the grain sorghums are so perfectly adapted and so evidently supreme in their particular domain that they achieve an importance in excess of their statistical rank as farm crops. To those who wonder why their use has not developed more rapidly, in view of their proven value, it can only be said that changes in crops or cropping methods must necessarily be slow. Progress must be measured not by years but by decades if stability of production is to be assured. Farmers are confessedly conservative. It is well. Were it not so the world might face famine as often as business faces panic.

IN THE ANCESTRAL HOME—USERS AND USES.

Wherever the white man's love of adventure and discovery has led him, he has always found primitive peoples using strange new plants for food. The early explorers and colonists of America found the Amerinds cultivating maize and the native Indians of the Titicaca plateau in Peru, at elevations of 11,000 to 14,000 feet, making use of quinoa, a kind of lamb's-quarter (*Chenopodium quinoa*). The traders and adventurers who first touched India and China gained their principal impressions from the port cities and recorded that the people of those countries lived chiefly on rice, a fiction that still persists. Later travelers, who reached the interior, found wheat, sorghums, and millets to be staple articles of diet. The sorghums were used mainly by the poorer classes or in times of scarcity.

In India the two large southern presidencies, Bombay and Madras, nearly 1,500 miles long and half as wide, are the best-known areas of sorghum production. The crop is important, however, in the States lying farther to the north. It was estimated a few years ago that the area annually devoted to sorghums in India was 25,000,000 acres. More than 300 varieties have been imported from there and grown by the United States Department of Agriculture. A great diversity of forms was found, the plants varying from dwarf and stocky to tall and slender (Pl. XXIX, fig. 1) and the heads having as wide a range of variation. Some curious varieties were found, having two seeds in each spikelet instead of the customary one, a phenomenon occurring regularly in occasional spikelets of cultivated sorgos in this country. Other forms had long and pointed glumes, like the hulls of oats, projecting far beyond the apex of the seed.

In China, Manchuria, and Chosen (Korea) a distinct group of grain-producing sorghums, the kaoliangs, have been developed (Pl. XXIX, fig. 2). They range from Yunnan, on the mountainous frontier of Tibet, to far Manchuria, a stretch of more than 2,000 miles. Dwarfs less than a yard in height and slender sapling stems 20 feet or more tall are found (Pl. XXIX, fig. 3). Between these are all the intermediates one might well expect. In head forms and seed colors the gamut is equally complete.

It is among the frugal and industrious Chinese and Manchus that the grain sorghums are put to the most varied

uses. Besides the meal and porridge made from the seeds and the fodder derived from the whole plant, the thrashed heads are used for fuel and certain sorts for brooms; the leaves are used for fodder and for mats; the stalks for baskets, light bridges, fences, fuel, hedges, house-building material, kite frames, laths, matting, playthings, posts, thatching, trellises, windbreaks, withes, and window shades, while even the roots and attached stubble are carefully dug and saved for fuel. The seed is also commonly used to make a fermented drink, or beer.

When we survey Africa, however, the real abundance and diversity of the cultivated members of the sorghum family are seen. They are found in every nook and corner of the great peninsular continent. Five thousand miles from northern sea to southern cape she lies, and 4,000 from ocean to ocean. From Morocco to Egypt, from Egypt to the Cape; again from the Cape northward to the old Slave Coast; and throughout the length of the Sudan, from Senegal on the west to Abyssinia on the east, this crop occurs. On the dry plains, in the oases of the Sahara, on high plateaus, and in mountain valleys, in tropical jungles and temperate veldts, throughout the length and breadth of Africa, sorghum is the one ever-present crop, though the forms are as diverse as the conditions under which they grow. The plants vary in height from 3 or 4 to probably 20 feet (Pl. XXX, fig. 1). The heads vary in shape and structure from ovate and densely compact to loosely cylindrical, to fan-shaped forms, and to long and flowing feathery plumes. In length they vary from 5 to 25 inches. The seeds vary in color from white to pink, red, brown, and yellow, with an occasional tinge of blue. Everywhere they are used by the native tribes for human food, for the making of fermented drinks, and as fodder for live stock where such is owned.

IMMIGRANTS IN A NEW COUNTRY.

THE DURRAS.

In 1874, two durras, Brown and White, arrived at the port of San Francisco, though whether by first cabin, second cabin, or steerage is not recorded. Their passage had been booked from Egypt, but it is now known that their African home was in the old Barbary States of Algeria and Tunis and in the oases of the Sahara. Out to the ranches in the

two great inland valleys of the State they went and proved their entire ability to withstand the far-famed California climate. During the next few years they were allowed to occupy the wide space between rows of young grapes, almonds, and plums until it was needed by the growing fruits. In return, they fed the rancher's work stock, cows, and chickens.

THE KAFIRS.

While this little foreign colony was being planted in California, something was doing on the Atlantic coast, 2,500 miles away. In the year 1876 a great international exposition was held in Philadelphia to commemorate the hundredth anniversary of American independence. Among the many foreign exhibits at the Centennial Exposition was that of the Orange River Colony, later known as the Orange Free State, and now a part of the great Union of South Africa. In this exhibit were two samples of small, hard, egg-shaped seeds, one white, the other a red-brown (see Pl. XXXI, fig. 1, *C* and *D*), two varieties of the so-called "Kafir corn" (Pl. XXX, fig. 2) of South Africa.

How slender is the chain which connects these two samples of seed lying in a Philadelphia exhibit with the thriving industry of the dry-land West! Probably hundreds and thousands of visitors looked at the strange new seeds and thought no more of them, or noted only that they were sorghums from South Africa, whence had come, some 20 years before, the sorgos or sweet sorghums which America still hoped would one day fill her sugar bowl. Of all these sightseers, only two, so far as we have any record, were interested enough to ask for samples. Perhaps these two had come in touch at Philadelphia; who knows? One was a Georgia planter, Mr. J. A. Meeker, of Marietta, who took the seeds home and grew the plants for a few years, but finally lost his stock of seed by mice and rats. The second was an English officer from Egypt, said to have been a Gen. Graves, who traveled through the South after visiting the exposition. He left a very small quantity of the white seed at the Georgia State Department of Agriculture, during his stop in Atlanta.

On February 14, 1877, a thimbleful of the seed was sent by Dr. T. P. Janes, then State commissioner of agriculture, to Dr. J. H. Watkins, of Palmetto, Ga. For eight years, from 1877 to 1884, he grew it, selected it, and increased his

FIG. 1.—PLANTS OF DIFFERENT VARIETIES OF SORGHUM FROM INDIA.
(Photographed by author.)

FIG. 2.—FIELD OF KAOLIANG CURING IN THE SHOCK, HARBIN, MANCHURIA.
(Photographed by Frank N. Meyer.)

FIG. 3.—FIVE VARIETIES OF KAOLIANG.

Left to right: C. I. No. 273 (S. P. I. No. 21078), Valley Brown; C. I. No. 293 (S. P. I. No. 22011), Shantung Dwarf; C. I. No. 309 (S. P. I. No. 22911), Valley Brown; C. I. No. 272 (S. P. I. No. 21077), Mukden White; C. I. No. 310 (S. P. I. No. 22912), Barchet Blackhull. (Photographed by author, 1908.)

FIG. 1.—PLANTS OF TWO ABYSSINIAN SORGHUMS.

S. P. I. No. 11084, tall and still growing, September 26, 1906, and S. P. I. No. 11062, 3 feet tall and in fruit, September 16, 1905. (Photographed by author.)

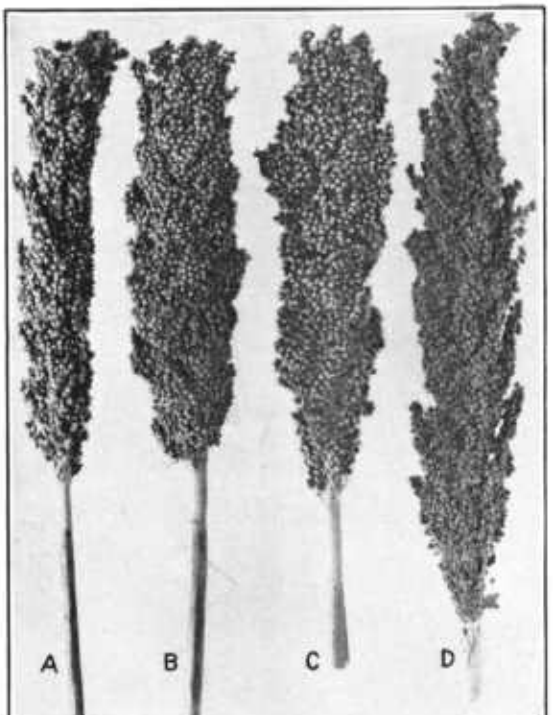

FIG. 2.—HEADS OF FOUR VARIETIES OF KAFIR.

A, White kafir; *B*, Guinea kafir (Guinea corn of the West Indies); *C*, Blackhull kafir; *D*, Red kafir. (About one-fifth natural size.)

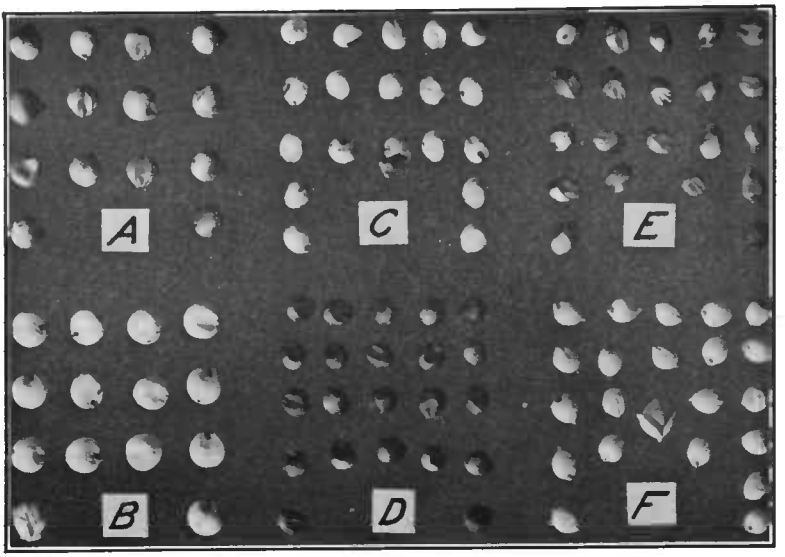

FIG. 1.—SEEDS OF GRAIN SORGHUMS.

A, Milo; *B*, White durra; *C*, Blackhull kafir; *D*, Red kafir; *E*, Brown kaoliang; *F*, Shallu. (Slightly reduced.)

FIG. 2.—PLAT OF DWARF MILO, SHOWING PENDENT (GOOSENECKED) HEADS.

(Photographed by author.)

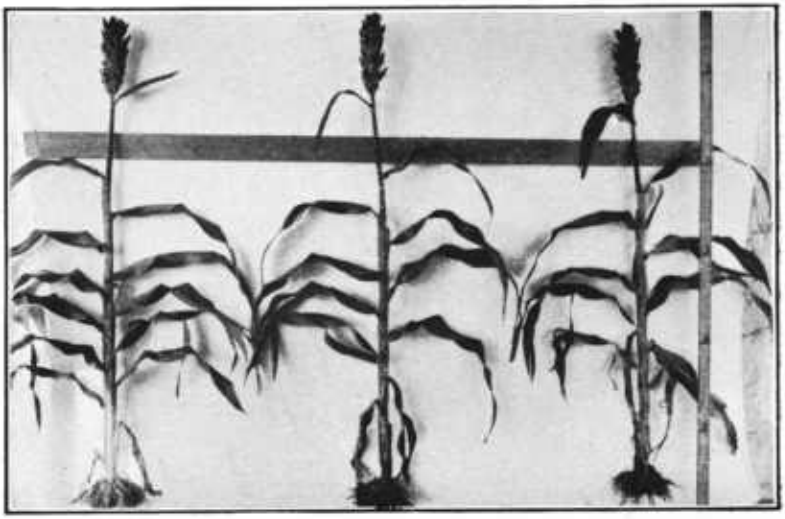

FIG. 1.—THREE PLANTS OF BLACKHULL KAFIR, 5.5 FEET HIGH, SELECTED FOR LOW STATURE AND HIGH YIELDING POWER.

(Photographed by author.)

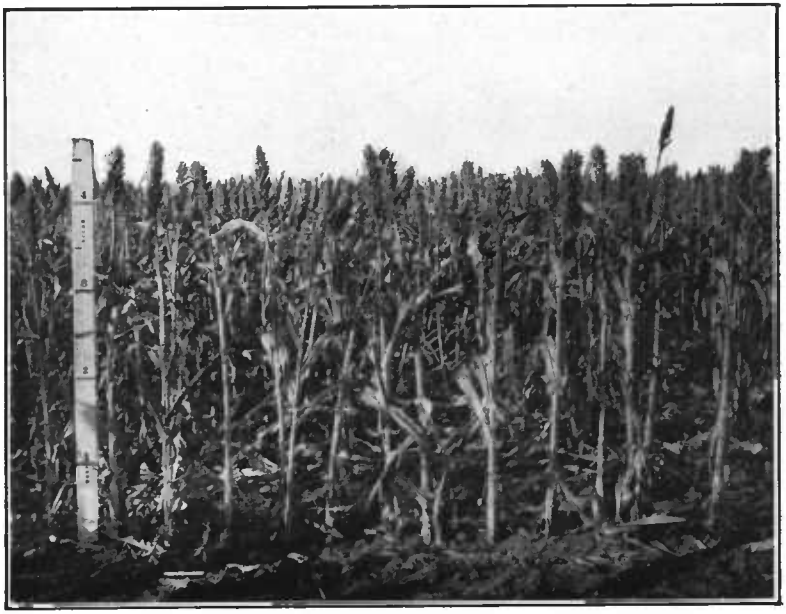

FIG. 2.—ORIGINAL PLAT OF DWARF AND EARLY BLACKHULL KAFIR (C. I. NO. 340.)

(Photographed by author.)

stock of seed. In 1885 and 1886 he began to distribute it personally and through the Georgia State Department of Agriculture, and in 1886 through Hon. Norman J. Colman, United States Commissioner of Agriculture.

THE MILOS.

Just at the time the White kafir was being sent out on its first missionary journeys to the dry-land West, there appeared a new sorghum immigrant in the South. It was first brought to notice in South Carolina, but no one knows just when or whence it came. Almost certainly, however, it arrived from Africa, and perhaps as a stowaway. Relatives have since been found in irrigated Egypt, but the same plant has not again appeared. In this country it was first known as "yellow millo maize." The crop most commonly known at that time as "millo maize," however, was a white-seeded variety (see Pl. XXX, fig. 2, *B*) from the West Indies, called there "Guinea corn" by the English and "petit millet" by the French. The yellow-seeded immigrant never became well known in the South, but was carried westward early by emigrating planters and soon became established in Texas.

FIGHTING DROUGHT ON THE PLAINS.

While the immigrant crops already described were finding place in the older settled States, the thin skirmish line of pioneer farmers had been thrown far out into the Great American Desert. These were followed closely by the larger army of settlers seeking homes on the newer, cheaper lands of the West.

Kansas bore the brunt of the battle against the desert. Oklahoma was largely closed to settlement until 1890, and much of western Texas was occupied and dominated by immense cattle ranches. Within the borders of Kansas, however, the influx of settlers was very rapid. The population increased more in the three years 1871–1873, inclusive, than in the entire decade previous. This was due partly to the early history of the State, partly to encouragement given to settlers by State agencies, and partly because of the early building of two transcontinental railways across the Commonwealth.

Settlers from the older and more humid States, good farmers under the conditions with which they were familiar, poured out into the Plains area during the decade beginning

with 1871. The crop varieties used were those adapted to more humid conditions. The principles of dry farming were then unknown, and experiments to determine them were not yet begun.

Disappointment and discouragement awaited many of the new settlers, especially those in the farthest West. Climatic conditions were much more severe than they had experienced or expected. Years of deficient rainfall and drought occurred. Sometimes gales of wind in spring destroyed young crops and moved vast quantities of soil from the fields to fence rows, farmyards, and other drift-making shelters. Hot and scorching winds in midsummer sometimes blasted crops in a single day. Immense swarms of hungry grasshoppers moved to and fro during 1874, devouring growing crops almost in a night. They appeared again in some sections for periods of two and three years thereafter. These conditions, especially the destructive winds and recurring drought, were wholly new and strange to most of the farmers.

Successive periods of drought rolled back the advancing wave of settlement time after time, now here, now there, leaving deserted farms and ruined villages in their wake. Settlers surveying the grass-covered and flower-tinted prairies in the warmth and beauty of spring could not realize the pitiless sky and parched earth of many a midsummer. It seemed to them incredible that so fair a prospect could be utterly mocked by the lack of a few inches of rain. Nor was the advice given them always of the best. As late as the end of 1880, a year of great drought, Kansas settlers were assured by the then professor of meteorology at their State University that increased rainfall with increased settlement was practically a certainty. Doubtless he was misled by the unsuspected incompleteness of early rainfall records from frontier army posts and by a certain apparent periodicity of precipitation in that area. At any rate, most who heard believed, because it was what they wanted to believe. Bad as 1880 had been, 1881 was far worse. Corn was a complete failure in the western counties, and the average acre yield for the entire State was less than 20 bushels. The native vegetation of the Plains consists of types which can withstand such adverse conditions, through one adaptation or another. Manifestly farm crops and farm practices also must have special adaptations in order to be successful in such an environment.

NEW CROPS AND A NEW HOPE.

Under the conditions described, one may well believe that earnest search was made for adapted crops. Sorghums were quickly in the minds of many. Sorgos or sweet sorghums had been grown by the earliest settlers and their drought resistance proved. Were all sorghums drought resistant? No one knew, but plenty were willing to try. Out in California, the two durras, there called "Egyptian corn," had been found to grow well on dry farms. They were brought to Kansas in 1879 and in the years 1880–1882 over 30,000 acres were grown annually, after which their production declined. In spite of their ability to withstand drought, they were not profitable. Of low stature and scanty foliage, they yielded little fodder where fodder was greatly in demand. The heads were pendent and troublesome to gather. The grain also shattered badly in the field in windy weather and during harvest. So sorgos were grown for forage and the search for an adapted grain crop continued.

In 1885 Dr. Watkins and the Georgia State Department of Agriculture first began to distribute the White kafir, and in 1886 the United States Department of Agriculture took part in the propaganda. As soon as it reached the dry lands it was seen to be adapted to the conditions. By 1888 it was appearing on the farms of Kansas. It was as drought resistant as any sorghum in the peculiar ability to suspend growth through considerable periods of drought and to resume growth when favorable conditions were restored. The stalks were erect and leafy and remained green until the seed was ripe, thus making good fodder as well as grain. The seed remained firmly held in the glumes while the crop cured in the field, thus preventing any waste. Here was the ideal crop for the dry country. Farm settlement took a fresh start, and the new crop and the new farm developed together.

Data on the acreage of kafir were first available for 1893, when there were 47,000 acres in Kansas. The acreage increased 100 per cent annually for the next three years and continued to increase to the end of the first decade covered by statistics, reaching high-water mark at three-quarters of a million acres in 1902. This maximum followed the seriously unfavorable season of 1901, when corn was a total failure in the western sections and yielded little more than

6 bushels to the acre for the entire State. Two or three years more favorable to corn and the lack of a profitable market for surplus kafir then checked the increase for the next eight years. From 1903 to 1910 the Kansas grain-sorghum acreage varied between 530,000 and 740,000 acres annually. In Oklahoma from 1904 to 1910 the area varied between 390,000 and 685,000 acres, the maximum occurring in 1909.

Meantime chemical analysis had shown the grain sorghums (Pl. XXXI, fig. 1) to be very similar to corn in composition. Digestion trials and feeding tests had proved them to have 90 per cent of the value of corn for feeding purposes. A 10 per cent advantage in drought resistance and consequent average yield would make the grain sorghums equal to corn as farm crops. This advantage they had, and more. At the same time field experiments with these crops were showing the need of new theories to account for the behavior of different varieties under similar conditions.

RESISTING OR ESCAPING DROUGHT.

That sorghums of all kinds were drought resistant was very early apparent. That some sorts escaped from as well as resisted drought was slower to be realized. Such varieties as did best in dry seasons were thought to be more drought resistant in some way than other varieties. Gradually came a better knowledge of the movement and storage of soil moisture and of its transpiration by dry-land crops. It was seen that earliness aided a crop to escape drought by shortening the period during which water was required. Dwarf stature and small leaf area also helped to reduce the quantity of water needed in any given period.

Thus was recognized the existence and value of characters which enable drought-resistant crops further to escape and evade drought. Dwarf plants with small leaf area may escape drought when it occurs because they use the stored soil water more slowly than larger plants with larger leaf areas. Thus the stored supply may last until they are mature or until the drought is broken. Earliness aids the plant to evade drought by bringing it to maturity before the drought occurs or becomes severe. When these principles became fully recognized, the quest for dwarf and early strains was given a great impetus. The need of such strains

for use farther north and at higher elevations had been felt before. To this need was now added the equally pressing need for drought escapers.

BREEDING DROUGHT ESCAPERS.

The search for dwarf and early strains to meet these needs and conditions was begun promptly by the United States Department of Agriculture. While explorers ransacked the corners of the earth for desirable forms, breeding was commenced with the most promising material in hand.

A dwarf strain of milo (Pl. XXXI, fig. 2), its origin unknown, was already here, needing little improvement except in the matter of pendent heads. The White kafir as originally introduced in the Plains was fairly dwarf and early, but it had one serious defect, namely, the tendency of the heads to remain partly included in the boot. This must be overcome if it was to be of value. Dwarf strains and early strains of Blackhull kafir, the favorite crop, were yet to be created.

From the many strains of Blackhull kafir under test a large number of head selections were made from stalks having low stature (Pl. XXXII, fig. 1) and other desirable characters. In the summer of 1908 an extra dwarf row appeared in the series of dwarf selections. From this row was bred the Dwarf kafir (Pl. XXXII, fig. 2), now becoming so popular. It reaches a height of only 3 to 4 feet and matures 7 to 10 days earlier than ordinary acclimated strains of Blackhull kafir. It can thus be grown in a shorter season than other strains and is also more drought escaping. At the same time and from the same source was produced an early-maturing strain which retains the height of the ordinary kafir. In Plate XXXIII are shown the comparative earliness of the Dwarf and Standard Blackhull kafirs, growing side by side on the high plains of northwestern Texas.

In 1907 another immigrant came to us out of Africa. This time it was from the wild and turbulent region of the British Egyptian Sudan—from historic Khartum, where "Chinese" Gordon wrought and ruled and where he finally perished in the fanatical uprising that closed the Sudan for long and bitter years. This durra variety, known as feterita, or Sudan durra (Pl. XXXIV, fig. 1), is marked by erect heads, white seed, fairly dwarf stature, and early maturity. These are all desirable characters, and it gives promise of some

value as a dry-land crop. Just now enormously inflated values are being ascribed to it because in many cases it produced grain in 1913 when kafir and even milo failed. However, its larger, softer seed and somewhat weaker germination cause rather thinner stands than are obtained from kafir and milo. In the dry season of 1913 these thin stands were its salvation, as has been noted also in other seasons. What its permanent place and value shall be it is yet too early to predict.

It was soon found that the milos and durras could not be depended upon to furnish grain as far north as Nebraska and South Dakota. The heat units available, especially at night, seemed insufficient. Could sorghums be found which had acquired, through the centuries, that acclimation and adaptation to northern climates needed in this case? The southern boundary of South Dakota is in latitude 43° and the north line about 46°. The only region in the world which grows sorghums abundantly as far as 40° from the equator is Manchuria. Many varieties of the kaoliang from northern China, Manchuria, and Korea were obtained, tested, and classified. (See Pl. XXIX, fig. 3.) The earliest of all proved to be a plant of medium size from Manchuria (Pl. XXXIV, fig. 2), which was described and named Manchu Brown (C. I. Nos. 171, 261, and 328). While not a heavy yielder, it has consistently outyielded corn in the central part of South Dakota and is now being distributed to South Dakota farmers by the State experiment station and the United States Department of Agriculture.

MAKING GOOD.

During those years when the grain-sorghum acreage was increasing most rapidly, as also in the later 8-year period when it remained stationary, the area devoted to corn was steadily enlarged. Corn was king, his supremacy as yet unchallenged. To deny his royalty was treason. But the appreciation of kafir and milo as comparatively safe crops in dry seasons was increasing. So was the knowledge that corn was a doomed crop in a year of drought. Land sellers still said corn was the crop to grow; ergo, corn must be grown. But facts are stubborn things. The theory of increasing rainfall had long since been dried out of the most credulous minds. Empty pockets and empty stomachs speak louder than tongues and are far more efficient in opening eyes and dis-

arming prejudice. Promoters and growers alike began to see a great light. Reduction of the corn acreage was openly advocated. Farmers, farm papers, scientists, merchants, bankkers, land men, and railroads all joined in an aggressive campaign to promote the growing of kafir and milo instead of corn in the drier Plains. In Oklahoma it was even seriously proposed that credit and loans be denied to any farmer not planting at least a certain acreage of kafir. Doubtless some foolish talk was indulged in and much foolish advice given during the campaign, but of the results there can be no doubt. There was a decided decrease in the acreage of corn and a comparatively enormous increase in the area devoted to grain sorghums.

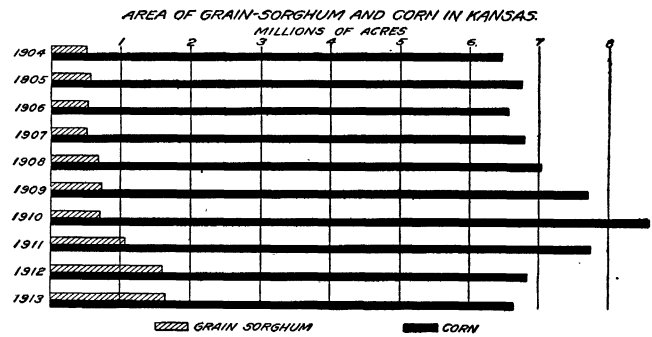

FIG. 5.—Graphic presentation of the comparative area in millions of acres of grain sorghum and corn in Kansas for the ten years 1904–1913, inclusive.

The coincidence of the declining corn area and the increasing acreage of kafir and milo in Kansas can be seen at a glance in figures 5 and 9. Figure 5 tells the story for Kansas as a whole and figure 9 for the 46 counties comprising the western half. In this State the grain-sorghum area jumped to 1,093,000 acres in 1911, 1,605,000 acres in 1912, and 1,633,000 acres in 1913. The maximum area devoted to corn in Kansas was 8,590,000 acres grown in 1910. In 1911 and 1912 the area decreased nearly 1,000,000 acres a year.

What caused the rapid change in comparative acreage? A growing knowledge of comparative acre values! Mere acres count for little unless they produce profits. Figure 6 shows the acre value of both crops in Kansas during the last 10 years. For the entire State the average acre value of

kafir and milo was $2.14 greater than that of corn. The production of these crops is also more regular and evenly distributed. These statistics, taken from the reports of the Kansas State Board of Agriculture, are not wholly fair to corn, however. They include the value of both grain and stover in grain sorghums, but only the grain value of the corn. If the stover value of corn were included the average values would be more nearly equal.

How nature helped to swing the pendulum is seen when corn yields are considered. For 1907 to 1909 the average yield in Kansas was only about 20 bushels per acre; in 1910 less than 18 bushels; in 1911 less than 13 bushels; in 1912 it

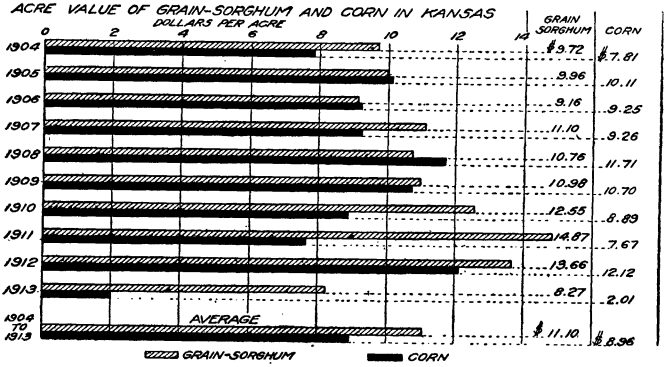

FIG. 6.—Graphic presentation of the annual acre value in dollars per acre of grain sorghum and corn in Kansas for the ten years 1904–1913, inclusive, and average acre value for the 10-year period.

increased to nearly 23 bushels, but in 1913 was only 2.75 bushels. It would be very interesting to compare the yields of grain sorghum and corn, but unfortunately statistics of the former are given in tons of crop and of the latter in bushels of grain.

While this was being done in Kansas, Oklahoma also was making history. Figure 7 tells the story of Oklahoma's acres, while figure 11 shows what happened in the 21 counties contained in the western third of the State. She produced 625,000 acres of grain sorghums in 1910 and 873,000 acres in 1911, an increase of a quarter million acres. No data for 1912 and 1913 are available, but there is every reason to believe, from the vigorous campaign waged, that the increase was proportional to that in Kansas. Oklahoma reached her maximum corn area in 1909 with 5,135,000

FIG. 1.—A PLAT OF DWARF BLACKHULL KAFIR (C. I. NO. 340), AUGUST 31, 1911.

Compare its earliness with that of standard Blackhull kafir (fig. 2) planted on the same day. (Photographed by author.)

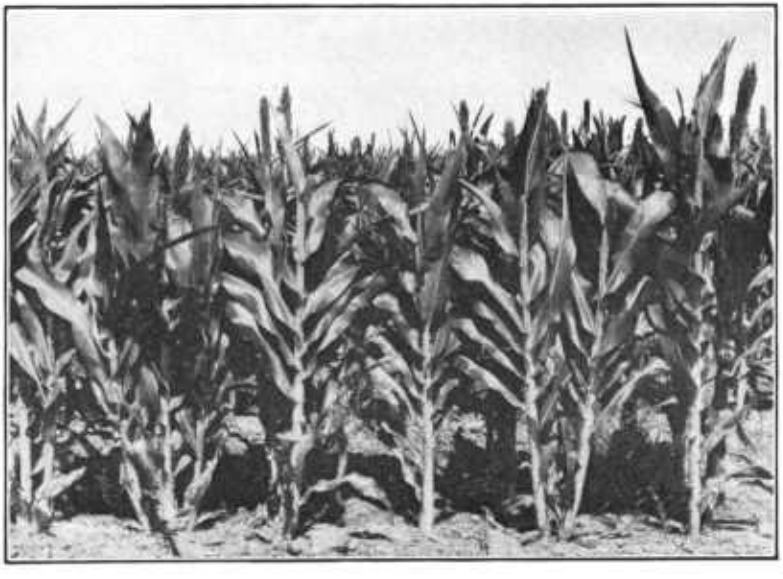

FIG. 2.—A PLAT OF BLACKHULL KAFIR (C. I. NO. 71), AUGUST 31, 1911.

Compare the stage of development with that of the Dwarf Blackhull kafir in figure 1, planted on the same day in an adjacent plat. (Photographed by author.)

FIG. 1.—A PLAT OF FETERITA, SHOWING THIN STAND AND UNEVEN GROWTH.
(Photographed by author, August 31, 1911.)

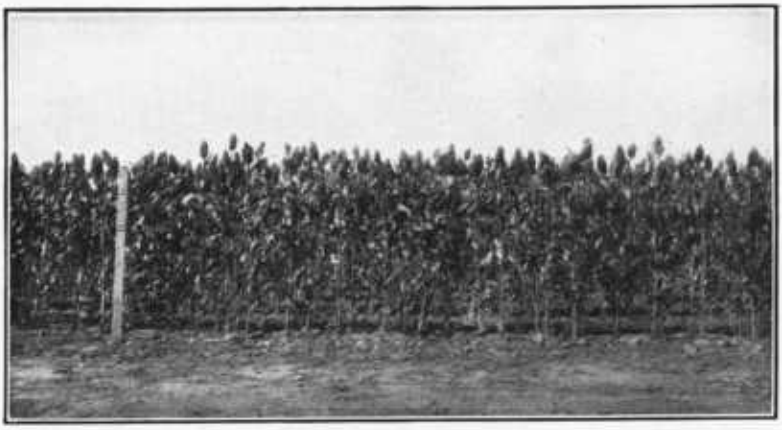

FIG. 2.—PLAT OF SELECTED MANCHU KAOLIANG (C. I. NO. 171).
(Photographed by author.)

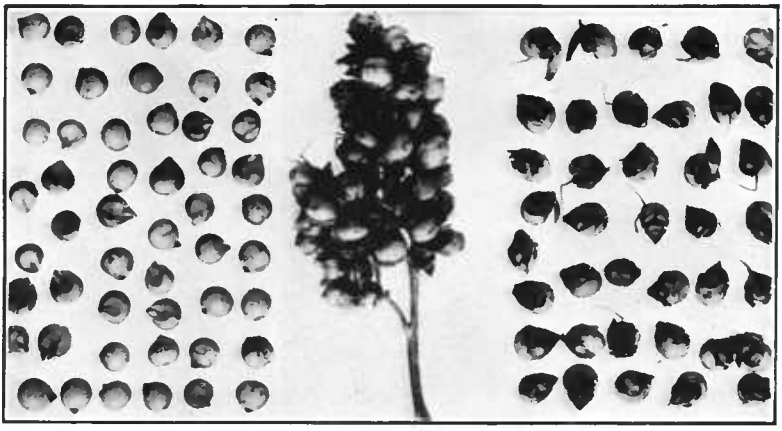

FIG. 1.—MILO SEEDS, HULLED AND UNHULLED, AND A SMALL BRANCH OF A HEAD. (NATURAL SIZE.)

FIG. 2.—MILO FIELD IN SHOCK, XIT RANCH, CHANNING, TEX., SEPTEMBER 18, 1906.
(Photographed by author.)

FIG. 3.—FIELD OF MILO AS IMPROVED BY SELECTION, FROM 4 TO 4½ FEET TALL, SLENDER, WITHOUT BRANCHES, HEADS MOSTLY ERECT.
(Photographed by author.)

acres. In 1910 and 1911 the decline was at the rate of more than a million acres a year, as shown in figure 7.

Figure 8 shows the acre value of both crops in Oklahoma for eight years, beginning in 1904. Corn has an average ad-

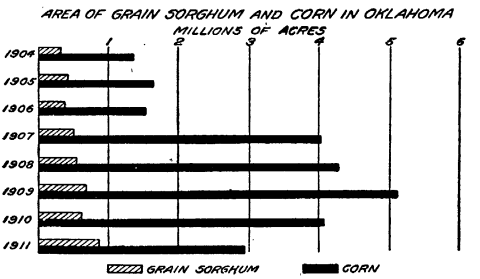

FIG. 7.—Graphic presentation of the comparative area in millions of acres of grain sorghum and corn in Oklahoma for the eight years 1904–1911, inclusive.

vantage of $2.26 per acre for the period. This reversal of the Kansas figures is due to three or four things which profit corn. Oklahoma lies in a more southerly latitude than Kansas. The Oklahoma statistics include the stover value of only a small part of the grain sorghum. The grain sorghums are largely restricted to the drier western third of Oklahoma. (See fig. 11.) The very unfavorable season of 1913 is not included, for lack of data.

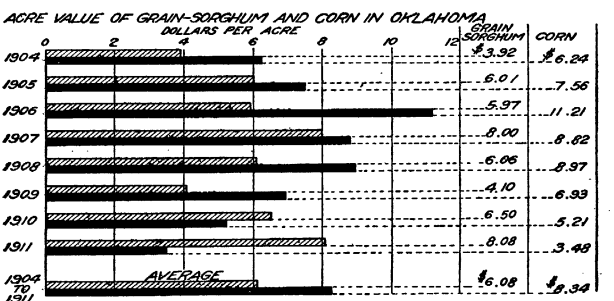

FIG. 8.—Graphic presentation of the annual acre value in dollars per acre of grain sorghum and corn in Oklahoma for the eight years 1904–1911, inclusive, and average acre value for the eight-year period.

In Oklahoma the average yield of corn in 1907 and 1908 was less than 19 bushels; in 1909 less than 14 bushels; in 1910 less than 12 bushels; and in 1911 little more than 6 bushels. Statistics of production for 1912 and 1913 are not available, but it is certain that the average yield in 1913 was very small. Such yields for the entire State usually mean

almost complete failure of corn in the western portions. The actual annual yields of the grain sorghums would be very desirable here, also, but a portion of the crop is reported in

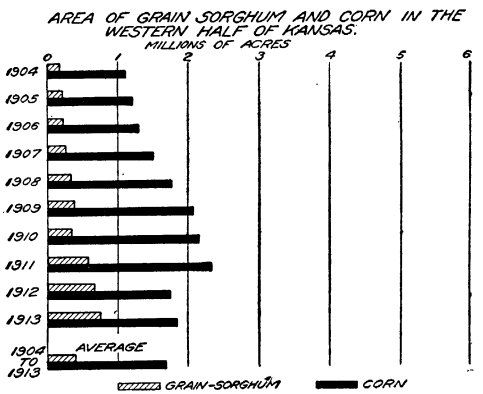

FIG. 9.—Graphic presentation of the area in millions of acres of grain sorghum and corn in the 46 counties comprising the western half of Kansas and lying wholly west of the ninety-eighth meridian, for the 10 years 1904–1913, inclusive, and average area for the 10-year period.

bushels of grain and the remainder in tons of crop and the acreage is not separated.

Where then should kafir and milo be grown in preference to corn? Figures 9, 10, 11, and 12 assist in answering this

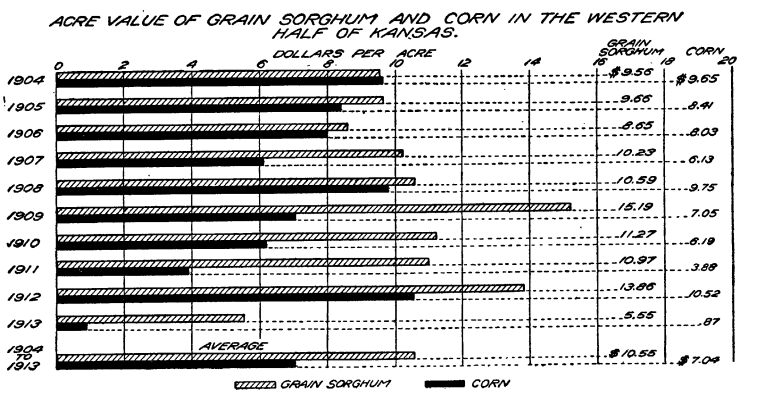

FIG. 10.—Graphic presentation of the annual acre value in dollars per acre of grain sorghum and corn in the 46 counties comprising the western half of Kansas and lying wholly west of the ninety-eighth meridian, for the 10 years 1904–1913, inclusive, and average acre value for the 10-year period.

question. Half of Kansas, containing 46 counties, lies west of the ninety-eighth meridian. Figure 9 shows the area of grain

sorghum and corn in those counties. Nineteen of them already grow more kafir and milo than corn. The average acre value for this area, as shown in figure 10, proves the grain sorghum to be the more profitable crop. We have already seen that for the whole State of Kansas the average acre value of the grain sorghums was $2.14 higher than that of corn during the 10-year period, while in the western half of the State it was $3.51 higher. These figures include the value of the grain-sorghum stover, but not that of corn. However, corn stover is scanty and worth but little in dry areas. After allowing a fair price for it, the grain sorghums are still worth considerably more per acre than corn in the drier portion of

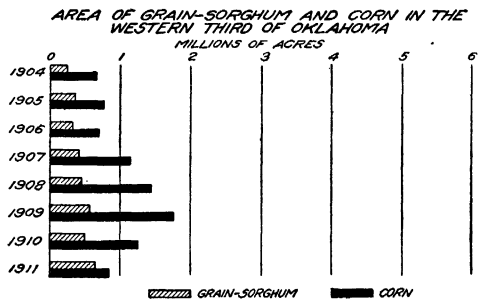

FIG. 11.—Graphic presentation of the annual area in millions of acres of grain sorghum and corn in the 21 counties comprising the western third of Oklahoma and lying wholly west of the ninety-eighth meridian, for the 8 years 1904–1911, inclusive.

the State. This fact, together with their more uniformly certain production, ought to cause further increase in the acreage of kafir and milo in western Kansas.

A comparison of figure 9 with figure 5 shows that fully half of the Kansas grain sorghum is grown in the eastern half of the State. The acre value for the entire State indicates, moreover, that it pays to grow it in eastern Kansas, at least on the uplands.

Similarly, one-third of Oklahoma, containing 21 counties, lies west of the ninety-eighth meridian. Figure 11 shows the acreage in this area of the two crops under discussion. Nine of these counties in 1911 grew more kafir and milo than corn. Figure 12 tells why they did it and why more of them probably were doing it in 1913. In sharp contrast to Kansas, a comparison of figure 11 and figure 7 shows only about one-fifth of the grain-sorghum crop grown in the eastern

two-thirds of the State. When we consider the acre values given in figure 8 for all Oklahoma and in figure 12 for the western third, there is developed a deep suspicion that it would be very profitable to grow kafir and milo farther east in Oklahoma.

Meanwhile what of Texas, the great dry-farming empire of the South? We know that during the years when the kafir industry was developing in Kansas, milo had been carried into Texas by westward-faring emigrants. Gradually it became established on the farms and ranches of the drier western portions of the State (Plate XXXV). No statistical data are to be had, but we know it increased steadily and

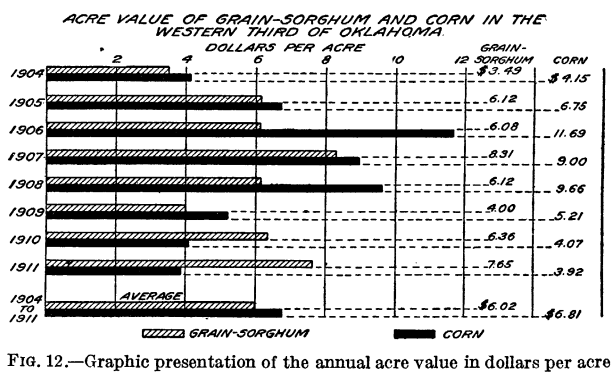

FIG. 12.—Graphic presentation of the annual acre value in dollars per acre of grain sorghum and corn in the 21 counties comprising the western third of Oklahoma and lying wholly west of the ninety-eighth meridian, for the 8 years 1904–1911, inclusive, and average acre value for the 8-year period.

also that the kafirs were soon introduced and became popular. There is every reason to believe that the area devoted to these two crops in Texas has more than equaled the area grown in Kansas, at least until the recent enormous increase.

It is to be regretted that no complete and separate statistics of the acreage and production of grain sorghums are obtained by the Federal Census Bureau. Separate data are now gathered and reported on that portion of the crop from which the grain is thrashed. The portion, however, which is not thrashed, but fed either in the head or bundle, or used for silage, is lumped with fodder and silage corn, sorgos (saccharine sorghums), pearl millet, teosinte, etc., as coarse forage. The acreage represented by each crop is not shown separately. Much of the kafir and milo crop grown in western Oklahoma and western Texas is not thrashed because of the scarcity

of grain separators, this section not producing very large quantities of other cereals. The acreage and importance of grain sorghums would now seem fully to warrant the obtaining and publication of complete statistics of acreage and production wholly apart from those of any other crop.

FEEDING THE FARM STOCK AND THE FARM FAMILY.

From the beginning the kafirs and milos have fed the farm horses that worked to raise the settler's crop and the faithful cow that gave his children drink. They have fed the hogs that fit so handily into the economy of every farm. They have fed the chickens that, more often than is known, have stood between the new settler and privation or failure.

With the testimony of the chemical analysis and feeding experiment, kafir and milo grain began to enter the feeding ration of beef cattle on the Plains. Kafir chops and milo chops became staple articles of bovine diet and kafir-fed cattle were commended at the great stock markets. Meantime the manufacturers of poultry feeds found in kafir the most desirable form of feeding grain. In the thousands of tons of such feeds made annually in the United States about 25 per cent of the material is kafir grain.

These grains have also a place in the human diet. Ground in the coffee mill on the wall of the farm kitchen, the meal has made many a stack of batter cakes on winter mornings. Mixed with varying proportions of wheat flour it is susceptible of every use to which corn meal may be put. As flour it will always be a failure. Like corn meal, it contains no gluten and so will not rise as dough, no matter how much it be coaxed. But as meal it has a flavor of its own and a wide range of usefulness in plain and tasty cooking. Muffins, brown bread, corn cakes, and pancakes par excellence are for him who uses it. In puddings and in pastries it will do all that corn meal may.

At last the grain sorghums had come into their own. No longer were they to be regarded as servants, faithful indeed, but inferior; no longer as poor relations of corn, honest, perhaps, but ragged. Now they were friends and equals, with a standing in the community won strictly on their merits.

IN SOCIETY AT LAST—A KAFIR CARNIVAL.

It was left to Butler County, Kans., to honor herself by arranging the first public reception ever given to kafir and milo in this country. Butler County is not in the drier western part of the State, but in the more humid southeastern section. Part of her soil, however, as that of some adjacent counties, is underlain at slight depths by rock, and the crops grown thereon are likely to suffer at times from lack of soil moisture. Kafir was first grown in Butler County in 1892, and it did not take her farmers long to realize that to such soils kafir was better adapted than corn. So the acreage of kafir increased year by year, until 100,000 acres were planted in 1911.

In the autumn of that year it occurred to the boosters of Butler County to celebrate their popular crop. A three-day kafir carnival was planned to take place on October 18–20 at El Dorado, the county seat. The carnival was an overwhelming success. For three days El Dorado was a kaleidoscope of color, a mecca of merriment. Fully 30,000 people are said to be have been present during the celebration. Kafir was in evidence everywhere. The booths were constructed of it, the buildings were decorated with it, the prizes were given for it. People came from all over Kansas to question and to ponder, and went away to praise.

IN CONCLUSION.

The grain sorghums have made good on the farm; they have been honored in the city. Their names are written in the social register and in the Who's Who of agronomy. They mingle with wheat and corn, the elect, on the boards of trade; they are rated high in the directories of commerce and finance. Hats off, and a hearty cheer as they go forward in the full strength of youth to quietly continue what they have thus far so splendidly done.